Final Report

Archaeological Inventory Survey and Monitoring in Support of Engineering Evaluation/Cost Analysis Activities, Former `Ōpana Point Bombing Range and Makawao Gunnery Site, Hamakualoa District, Island of Maui, Hawai`i

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May 2004

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ABSTRACT

Under contract to Donaldson Enterprises (DEI), AMEC Earth and Environmental has completed archaeological inventory survey, followed by monitoring during ordnance cleanup activities, in two U.S. Army properties: the former `Ōpana Point Bombing Range and the former Makawao Gunnery Site, both in Makawao District, Maui Island. The project was conducted in conjunction with U.S. Army Corps of Engineers Phase II Engineering Evaluation/Cost Analysis (EE/CA) ordnance removal. Both project areas had been used by the U.S. military for training maneuvers and live fire during the World War II era.

This report summarizes information concerning many archaeological sites recorded previously in gulches and other areas in areas near the two project parcels. During he current project, gulches were excluded from survey because discarded ordnance is expected to have accumulated downslope. No archaeological sites were recorded in either parcel during the current project. At `Ōpana Point, occasional traditional Hawaiian cultural materials (basalt flakes, marine shell) and manuports (culturally deposited, waterworn pebbles and cobbles) were observed in various locations on unpaved roads. These materials may have originated at one of two sites described previously along the cliffline, but now apparently destroyed. These sites were Pahoa Heiau (State Site Number 50-50-06-0062) and a lithic scatter -- a probable workshop (Site 50-50-06-5108) -- adjacent to the *heiau* site. The only artifact observed in the Makawao Gunnery Site was a nineteenth-century dark green glass bottle.

Eleven MK-23 4-pound practice bombs were found by the archaeological team during survey at `Ōpana Point. The total number of practice bombs recovered by all members of the project team during all phases of the project in both parcels totals approximately 150. Two 60-mm mortars, two 105-mm artillery rounds, and a 4.5 barrage rocket were recovered during the cleanup phase.

Archaeological monitoring of any future ground-modifying activities, conducted by qualified archaeologists, is recommended in both project areas, to ensure that any undiscovered sites are documented.

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INTRODUCTION

Under contract to Donaldson Enterprises, Inc. (DEI), for the U.S. Army Engineer District, Honolulu (Contract No. DACA-83-99-D-0001, Delivery Order 11), AMEC Earth & Environmental, Inc. (AMEC), has completed archaeological inventory survey and monitoring at two Army properties on Maui: the former `Ōpana Point Bombing Range and the former Makawao Gunnery Site (Figures 1, 2 [all figures follow text]). The survey, initiated under the authority of the Defense Environmental Restoration Program for Formerly Used Defense Sites (DERP/FUDS), was conducted to prepare for engineering evaluation/cost analysis (EE/CA) removal of unexploded ordnance (UXO). The archaeological monitoring portion of the fieldwork accompanied testing for buried ordnance and ordnance removal.

PROJECT SCHEDULE AND PERSONNEL

The inventory survey was conducted between July 16 and 19, 2002, under the direction of Jane Allen, Ph.D., Principal Investigator/Project Director. The survey crew consisted of archaeologists Richard Nees, Constance O'Hare, and Tara Moorman, all with B.A. degrees. Ben Meinze of DEI provided UXO support services. Marty Ray of Zapata Engineering, Charlotte, North Carolina, provided GPS information and selected locations for future testing for ordnance deposits.

Archaeological monitoring was conducted by Richard Nees on September 9 and 20, 2002, during the EE/CA Phase II UXO investigations. Robin Hall of DEI served as UXO escort during monitoring, and Chris Rose, from Zapata Engineering, provided assistance.

PROJECT AREA LOCATION AND PHYSICAL ENVIRONMENT

Both the bombing range and the gunnery site are located within the district currently called Makawao (Armstrong 1983:21; Bier 2002). Makawao District was created by the Session Laws of 1909 (revised in 1932) to include lands in four traditional Maui districts (Hāmākualoa, Hāmākuapoko, Kona, and Honuaula), plus the island of Kaho`olawe. Prior to 1909, both project land parcels were parts of Hāmākualoa, a long, roughly triangular land unit between the traditional districts of Ko`olau in the east and Hāmākuapoko in the west. The apex of Hāmākualoa District was located at an inland boundary with Kipahulu, in the southeast; its wide base followed the north shoreline of the island (Sterling 1998:2 [especially map], 4; Walker 1931:65).

The former `Ōpana Point Bombing Range (TMK 2-08-03:17) covers approximately 21 hectares (ha) (52 acres) on the north coast, within `Ōpana *ahupua`a* (traditional Hawaiian land division, smaller than district; typically wedge-shaped, reaching from mountains to sea), extending southward approximately 550 m from the high coastal cliffs (Figure 3). Elevations range from approximately 23 meters (m) (75 feet) above sea level (asl) at the cliff to 46 m (150 feet) asl in the south. The project area is bounded in the east and west by wide, deep gulches. Manawai Gulch in the east also forms the east boundary for the *ahupua`a*. The west project area boundary is provided by a shorter drainage within the *ahupua`a* interior. This drainage is mapped as `Ōpana Gulch by Eblé et al. (1997:Figure 5), but that name may be incorrect, as Bier (2002) maps `Ōpana Gulch farther southeast. Both gulches bordering the project area contain roads and buildings apparently in current use.

According to Eblé et al. (1997:17), `Ōpana Point was developed as a small arms firing range before World War II and was used as a bombing range during World War II. The parcel was under pineapple cultivation by 1981 (Eblé et al. 1998:1982 photograph, Plate 3) and remained so until recently. The area was overgrown with short to waist-high grasses, other weeds, shrubs, and occasional pineapple plants in July 2002.

The former Makawao Gunnery Site (TMK 2-08-08:7 and 2-09-14:16), which is located inland, southeast of `Ōpana Point, consists of approximately 1,772 ha (4,378 acres) in Halehaku *ahupua`a*. From its north boundary approximately 200-650 m south of the Hāna Highway, the gunnery site extends approximately

2.5 kilometers (km) southward to an old road and a sugar cane irrigation ditch connected with the New Hāmākua Ditch (U.S. Geological Survey 1983). Elevations climb southward, from 183-213 m (600-700 feet) asl at the north boundary to 366 m (1,200 feet) asl in the south. The project area is bounded by Honopou Stream in the east, by Halehaku Gulch in the west.

The project scope of work (U.S. Army Engineer District, Honolulu, 2002:2) provides the following information. The gunnery site includes a former U.S. Marine artillery impact area that covered 405.5 ha (1,002 acres), and an area used as a regimental training camp during World War II. In the 1940s, a young person was wounded by unexploded ordnance; ordnance and explosive waste fragments have also been observed in the area more recently. The property is currently leased for cattle grazing.

Climate and Hydrology

Temperatures recorded at a 148-m elevation at Pa`uwela, west of (and at a higher elevation than) `Ōpana Point, range from approximately 18.3° to 31.1° Celsius (C) (65° to 88° Fahrenheit [F]); temperatures are highest in early autumn (Price 1983:64). The gunnery site is 183-213 m asl, and further inland, so is very slightly cooler. `Ōpana Point receives northeast trade winds, with occasional strong winds; wind gusts were very strong during the current survey. The gunnery site also receives trade winds.

Average annual rainfall at `Ōpana Point is between 1,270 and 1,524 millimeters (mm) (50-60 inches), that at the gunnery site around 1,905 mm (75 inches) (Price 1983:62). Numerous perennial and seasonal streams dissect areas in and around both properties. The two streams flanking `Ōpana Point were mapped as intermittent in 1983, but both Halehaku and Honopou Streams, bracketing the former Makawao Gunnery Site, were considered permanent (U.S. Geological Survey 1983).

Geology and Soils

Both `Ōpana Point and the gunnery site are located within the large area of East Maui that is dominated by basalts and andesites deposited by Haleakalā. Surface flows in both areas are Pleistocene Kula volcanic series basalt flows extruded along the north rift of the shield volcano between ca. 690,000 and 830,000 years ago, burying earlier, Honomanu flows (Macdonald et al. 1983:128-128, 303, 388-401). The Kula volcanic series includes primarily alkalic olivine basalt, the andesitic rock hawaiite, and ankaramite, a phenocrystic rock that grades into olivine basalt.

Two soil groups are represented within the former `Ōpana Point Bombing Range: Rock Land and the Pauwela series (Foote et al. 1972:Map Sheet 112). The coastal cliff is Rock Land (mapped as "rRK") composed of basalt or andesite or both, easily eroded, and with little soil. Southward from the cliff, the Pauwela clay nearest the coast slopes 15-25 percent (mapping symbol "PfD") and is subject to moderate erosion and medium runoff. The soil cover over most of the area formerly cultivated in pineapple is the type Pauwela clay, sloping only 3-7 percent ("PfB"), with slow runoff and slight erosion hazard. The surface, A-horizon soil, which is plowed in the type profile (described near the Hāna Highway southeast of `Ōpana Point), is dark grayish brown, slightly organic with many roots, and acidic. It overlies thick B and C horizons, respectively dark reddish brown with few roots and strong brown with none; both are very acidic. Depth to soft, saprolitic bedrock can be more than 150 centimeters (cm). This marginally to moderately fertile soil is used for pastureland, pineapple cultivation, woodland, and water supply.

The former Makawao Gunnery Site contains areas of the steeply sloping Pauwela clay (PfD) in the north, Rough Broken Land (rRR) in the drainages, and primarily Kailua silty clay sloping 3-25 percent (KBID) on tablelands between gulches. The Pauwela clay is as described above. Rough Broken Land is very steep land dissected by drainage channels; runoff is rapid and erosion active, but this unit is not always rocky and may contain areas of deep soils. The Kailua silty clay forms on igneous rock and is acidic, is well-drained, with slow runoff and slight erosion hazard, and may contain a deep root zone. The A-horizon topsoil at the type locality, east of the gunnery site, is plowed and dark brown; the B horizon includes dark brown to dark reddish brown silty clays and, at depth, a very dark gray silty clay loam

containing weathered basalt fragments. Total soil depth can exceed 100 cm. Rough Broken Land provides watershed; both it and the Kailua soil are used for pastureland, woodland, and wildlife habitat (Foote et al. 1972:53, 119, Map sheet 113).

Vegetation

The former `Ōpana Point Bombing Range is currently under bunch and other grasses, from low to very tall; and dense lantana (*Lantana camara*), Christmas berry (*Schinus terebinthifolius*), and beach naupaka (*Scaevola sericea*) thickets. Sparse, stunted ironwood (*Casuarina equisetifolia*) grows along the coastal cliff. *Noni* (*Morinda citrifolia*) and pineapple (*Ananas comosus*) were noted in the eastern portion of the area, as was bitter melon (balsam pear, *Momordica charantia*; Wagner et al. 1990:572).

Ground cover in many portions of the former Makawao Gunnery Site consists primarily of pasturelands covered by low grasses and herbaceous ground covers such as sensitive plant (*Mimosa pudica*), bordered along fencelines and streambanks by strips of forest containing species such as ironwood, java plum (*Eugenia cuminii*), *hau* (*Hibiscus tiliaceus*), paperbark (*Melaleuca quinquenervia*) (e.g., Figure 4), and pandanus (*Pandanus tectorius*). Other areas are covered by dense, tall grasses (Figure 5) and other plants such as *uluhe* (false staghorn fern, *Dicranopteris linearis*), which also covers many slopes. Guava (*Psidium guajava*) and strawberry guava (*Psidium cattleianum*) are common, as are *kolū* (*Acacia farnesiana*), lantana, and Christmas berry. Bamboos (unidentified species) thrive in deep valleys. Another fern, the endemic *moa* (*Cyrtandra paludosa*) grows around the bases of some trees on the plateaus.

HISTORICAL BACKGROUND

This section briefly summarizes the histories of the `Ōpana Point and Makawao Gunnery Site areas. The primary sources consulted include Eblé et al. (1997); the State Historic Preservation Division library, Department of Land and Natural Resources; the Corps of Engineers Pacific Division files; the State Archives; the State Library; and the Bishop Museum Archives.

EARLY HISTORY, FROM EUROPEAN CONTACT (A.D. 1778) TO A.D. 1900

As indicated, the traditional name for the district where both project areas are located was Hāmākualoa. Pukui (1983:288) recorded the traditional Hawaiian proverb, *Pe`epe`e puhala*, an epithet for the *kauwā* (slaves) of Hāmākualoa. In English, the epithet means "Hiders among the *hala* (*Pandanus tectorius*) trees."

According to oral historical accounts (Beckwith 1976:383; also, Dixon et al. 2002), Maui was officially divided into districts and smaller units, and the hierarchy of land control established, under the supervision of a *kahuna* (traditional priest) named Kalaihaohi`a during the reign of Kaka`alaneo. Traditional names like Hāmākualoa had been used for as much as 550 years before they were changed in 1909. Date ranges based on 25- and 30-year generational counts suggest that Kaka`alaneo may have ruled Maui during the first half of the fifteenth century; suggested dates range from ca. A.D.1360 (A.D. 1330 for his father, Kaulahea I, A.D. 1360 for contemporaries Ma`ilikukai` of O`ahu and Kauholanui-mahu of Hawai`i Island [Fornander 1916-1920:6:313; Fornander 1996:71, 78 footnote]) to ca. A.D. 1478 or 1538 (for Kaka`alaneo; Kolb 1991:66). Interestingly, some reports claim that two Spaniards visited the islands during Kaka`alaneo's rule (Fornander 1996:107; Kamakau 1996:95 footnote, 324).

Eblé et al. (1997:10) quote an account (by Hough, not seen here) concerning Cook's November 26, 1778, anchorage off the north shore of Maui, where he was supplied with pigs, plantains (presumably one of the three endemic *Plantago* species; Wagner et al. 1992:1049-1055), breadfruit (*Artocarpus altilis*), and other fruits. Fornander (1996:170) mentions that Cook's ships *Discovery* and *Resolution* both anchored off the north coast. Kahekili, the Mo`i of Maui and the defender of the island against the invading Kalani`ōpu`u

of Hawai`i Island, visited the *Discovery* on November 27, presenting a red feather cloak to Captain Clerke (Kuykendall and Day 1962:16). Three days later, Kalani`ōpu`u, the would-be conqueror of Maui, visited the *Resolution*, at anchor off the northeast end of Maui.

Hāmākualoa, the traditional district where the current project areas are located, figures indirectly in this story. The area has apparently been used militarily for a long time. Kalani`ōpu`u invaded Hāmākualoa from 1778 on, plundering the area; driven out by Kahekili, he attacked Ko`olau District and then returned to Hāmākualoa, where, accompanied by the warriors of Manihelelima (his governor of Hāna), he once again fought Kahekili's troops. Months of warfare ensued, turning the district into a major battleground). Kahekili eventually regained control of all of East Maui in 1781 (Fornander 1996:157, 215-216). Hāmākualoa again became a battleground (ca. 1790) when Kamehameha fought and killed Kapakahili, one of the war commanders who had served Kalanikūpule, the son of Kahekili (Kamakau 1992:142, 148).

In 1828, at an unknown location somewhere east of Halehaku (the *ahupua`a* where the gunnery site is located), a group of missionaries reported finding, a segment of an ancient rock-paved road built by Kihapi`ilani (probably Kiha-a-pi`ilani, a pre-Contact Maui chief (Pukui et al. 1986:110; Sterling 1998:101, 104). Fornander (1996:206) indicates that the road extended from Kaupō to Hāna.

Little information is available regarding life in Hāmākualoa between Contact and the late nineteenth century, a fact that becomes somewhat surprising when the census records are consulted. In 1831-1832, according to Schmitt (1973:18), out of a total estimated population of 35,062 on Maui, Hāmākualoa had the third highest population of any district: 3,661, after only Lahaina and Hana, with 4,028 and 3,816 respectively. By 1836, the population decreased in every Maui land unit assessed except one (Halimaile -- probably Hāli`ima`ile, an *ahupua`a* in Hāmākuapoko). The 1836 figure for Hāmākualoa is 2,329, a decrease of 1,332 in approximately four years (Schmitt 1973:38).

At mid-nineteenth century, during the official land redistribution known as the Great Mahele, many Hawaiian land parcels formerly held by the state (the kingdom) were awarded to private individuals. Research at the Hawaii State Archives yielded the Land Commission Awards (LCAs) listed in Table 1. These, all awarded in the `Ōpana and Halehaku areas, emphasize agricultural lands.

In the summer of 1853, John Papa Ii (1993:172) described seeing the cliffs of Hāmākua[-loa] from shipboard, and native trees *koa* (*Acacia koa*) and *kukui* (*Aleurites moluccana*) growing at Halehaku and Ha`ikū.

In 1880, a writer for the Hawaiian Tourist Guide reported that several kinds of native woods covered the area between Ha`ikū and Huelo. He included *koa*, *pū hala* (*hala*, pandanus), *`ōhi`a*, and *kukui* in his list and also mentioned the ferns and "other interesting vegetation" that filled the deep gulches that crossed the road. The same author stated that "native houses are scattered but they are not so numerous as they formerly were, and are continually growing fewer" (Bowser 1880:511).

Handy and Handy (1972:498) comment that the many small traditional *ahupua`a* that make up Hāmākua (-loa or -poko, or both) suggest a once-dense population. They also mention that several stream valleys once held *lo`i kalo* (pondfields for the cultivation of irrigated taro [*Colocasia esculenta*]), that lower forested lands probably sustained dryland taro, and that the area probably also supported breadfruit, bananas (*Musa* sp.), sugar cane (*Saccharum officinarum*), arrowroot (*Tacca leontopetaloides*), sweet potatoes (*Ipomoea batatas*), yams (*Dioscorea alata*), and *`awa* (*Piper methysticum*).

Kolb (1991:61) classifies Hāmākualoa as a Zone 1 area, a windward area with perennial streams, dependable rainfall, and wetland agriculture, but predicts that, since gullies and valleys in the district slope steeply, pondfield agriculture would have been confined to the mouths of streams. A growing body of archaeological evidence (reviewed later in this report) now suggests pondfield cultivation at least 1-2 km inland in gullies including at a minimum East Kaupakulua, Manawai`iao, and Manawai. The last two of these provide the east and west boundaries for `Ōpana *ahupua`a.*

Table 1

LCAs in the `Ōpana and Halehaku Areas, Hāmākualoa, Maui

LCA#	Location (General)	Claimant	Date	Description* (For definitions of Hawaiian words, see end of table)
5393	Halehaku	Hoomaikai	1/24/1848	*`Ili* of *lo`i* at Pohakaele, *`ili* of *kula* land of Pulauea, *opae* stream, 2 *olona* waters, Keahoiki and Wailua
6234	`Ōpana	Koleamoku	1/26/1848	"Independent" *`ili*, sweet potato *`ili*: Luahinepii, 1 *mala* of (dryland) taro; Maloa, 2 *mala* of *Iii*. "These claims are within Opana"
2937+	`Ōpana, Hāmākualoa	William Harbottle	4/18/1851	Kanamu sworn; he has seen his land named "Opana" in Hamakualoa, Maui, it is an *ahupua`a*. *Mauka***: Lot Kamehameha's land; Wailuku: Haiku, Kaalaea, Ulumalu, Kaupakulua; *Makai*: sea; Hana: Keaaula, Uaoa, Peahi *ahupua`a*
4753B	"from Opana as far as Halehaku"	Kahu	1/14/1848	*Olona*, *kihapai*, taro land, and "one entire land area, from Opana as far as Halehaku"
5499	Halehaku, land of Nahaolelua	I. Kauhi	1/21/1848	*`Ili* named Kahai: 28 *lo`i*, 8 places planted in *wauke*. At Mahine are 2 dry *pahu* and 5 *lo`i*
5508	Halehaku	Kapaahili	1/24/1848	"cultivated in various places"
5512	Halehaku	Kulani	1/22/1848	24 *lo`i*. Many trees: *kukui, koa, ohia*. "Stream for catching gobey fish and fresh water shrimp at Kawailoa," a *mo`o* of *wauke*, and "places planted in potatoes."
5519	Halehaku	Mana (index lists 5519B and also a 5519C belonging to Napohaku, but these are not in the registry)	No data (N.d.)	*`Ili* named Papalua: there "are 5 *mo`o*, however someone else has most of them. I have…"1 *mo`o* with 20 *lo`i*, breadfruit trees and some potato *mo`o*. At Punaiwa 2 taro *mo`o*. At Pilali: 3 potato *mo`o*. Kawailoa 1 *mo`o* of *wauke*.

(Table 1, continued)

LCA#	Location (General)	Claimant	Date	Description*
6510B, H, QQ, SS	`Ōpana	Keoho, Wiwi, Kupa, and Hanakahi	N.d.	No description
6510H	Halehaku	Wiwi	N.d.	No description
4753	?	Maiola	N.d.	No description
3905	Halehaku	Piopio	N.d.	No description

Definitions for Hawaiian words used in this table include the following (following Pukui and Elbert 1986):

`ili* = subdivision of *ahupua`a;
kīhāpai = garden;
koa = *Acacia koa*;
kukui = *Aleurites moluccana*;
kula = hillslope land;
lo`i = (usually taro) pondfield;
māla = cultivated field;
mo`o* = division of *`ili;
`ōhi`a = *Metrosideros polymorpha*;
olonā = *Touchardia* spp. (shrubs);
`ōpae = shrimp;
pahu = (probably) region above *kula* and below *`ilima* (*Sida fallax*; grows in mixed shrub and grassland (Pukui and Elbert 1986:301; Wagner et al. 1990:58); and
wauke = paper mulberry, *Broussonetia papyrifera*

** Lands adjoining this claim are described as *mauka* (toward mountains), Wailuku (toward Wailuku), *makai* (toward the ocean), and Hana (toward Hana).

+ This description was taken from the Native Testimonies; all others are from the Native Registry.

THE BEGINNING OF THE SUGAR ERA

Although Hāmākualoa was apparently never directly involved in plantation sugar cane cultivation, several irrigation ditches cross the area. Beginning in the late nineteenth century, these ditches transported water from Hāmākualoa and other North and East Maui areas to sugar plantations on the central plain (Bier 2002; Dorrance and Morgan 2000; U.S. Geological Survey 1983; Yardley 1981). Hāmākua Ditch, the first large-scale commercial ditch on Maui (the second in the islands), was built between 1876 and 1878 by Samuel T. Alexander and Henry P. Baldwin to transport water to four plantations (Dorrance and Morgan 2000:68; Thrum 1941:79). Although the original Hāmākua Ditch is located southeast of both the current project areas, the New Hāmākua Ditch marks the south boundary of the former Makawao

Gunnery Site. The original ditch connects with Wailoa Ditch, which was constructed between 1918 and 1928 by Eastern Maui Irrigation (formed by Alexander and Baldwin in 1908) after they purchased water-producing lands in Hāmākualoa and Ko`olau (Wilcox 1996:117). Wailoa Ditch is located a short distance south of the Makawao Gunnery Site.

In the north, Ha`ikū Ditch heads westward between `Ōpana Point and the gunnery site. Part of the long Lowrie Ditch crosses the gunnery site near its north boundary. Finally, a pipeline was built by Kula residents during the severe 1905 drought to transport water from Hāmākualoa to crops grown in Kula (Kolb and O'Claray 1997:58, citing research by Marks, not seen); it is not clear where in Hāmākualoa the pipeline originated.

PINEAPPLE CULTIVATION

Commercial pineapple cultivation began in the Hawaiian Islands in 1900, at Wahiawa, on O`ahu, but quickly spread to Maui and the other islands (Kuykendall and Day 1962:236), although large plantations are a more recent development in most areas. According to a Maui fact sheet available on the Internet, Dwight Baldwin planted the first commercial pineapple on Maui at Ha`ikū in 1903. Eblé et al. (1997:13-14), who summarize developments in the `Ōpana Point area, mention that Baldwin Packers was established at Honolua, Maui, in 1912 and became part of Maui Pineapple Company in 1962.

Pineapple grows well at higher altitudes than does sugar cane (to more than 900 m asl; Neal 1965:178), and is usually grown in belts above the sugar cane zone on Maui. The crop prefers a drier environment than cane, and in fact failed in very wet areas such as upland Kāne`ohe and Maunawili Valley, O`ahu, reportedly because of a mildew-causing disease that attacks the plant under wet conditions (e.g., Allen et al. 2002:62; Kelly 1987:305).

In 1930, four of eight pineapple canneries in the Hawaiian Islands were located on Maui (Eblé et al. 1997, citing research by M.C. Miller and L. K. Menton, not seen). In 1938, these four companies produced half of the pineapple grown in the territory.

Libby, McNeill, & Libby owned plantations in Ha`ikū, west of Ōpana Point, and may have been the owners of the plantation photographed from the air in 1982 (Eblé et al. 1997:Plate 3, citing Air Photo Hawaii 1982 as the source). Pineapple at that time covered Ōpana Point from Manawai Gulch in the east to Holumalu Gulch in the west. As noted above, occasional, now-wild pineapple plants still grow at the point. No pineapple was observed growing at the gunnery site, which has been modified by ranching activities since the nineteenth century. It remains uncertain whether the Makawao project parcel ever supported pineapple.

RANCHING

Hāmākualoa's lands were "well watered, well grassed, and thickly covered with guava bush [and] were believed to be well suited for general stock farming" (*Maui News* 1926:2). There is ample evidence of cattle ranching throughout the Makawao Gunnery Site (pastures, cattle guards and shoots, occasional buildings), but it is unclear who may have owned the cattle during the early years of the twentieth century and what ranch they were associated with. Grove Ranch, which later became the HC&S ranch department, was located near Hali`ima`ile, west of the Gunnery Site; and Homelani Ranch between Nali`iliha`ili and Puohokamoa Streams, east of the Gunnery Site. Both ranches supported beef cattle and dairy cows, and Homelani Ranch also had Berkshire and Poland China hogs and an independent poultry farm, "carried on at upper Makawao" (*Maui News* 1926:8).

WORLD WAR II

Maui did not house any U.S. military facilities until very late: in 1933, Maui, Lāna`i, and Moloka`i were the only three of the six main Hawaiian islands with no Army reservations or even flying fields. Maui

still lacked a U.S. Army facility as late as 1939, by which time a landing field was in operation on Moloka`i (Addleman 1939:53, 62).

Once war was declared on Japan, the military situation on Maui changed a great deal. The various branches of the military began acquiring lands. The Army's 391st Regiment, elements of the 33rd and 98th Divisions, the 136th Infantry RST, and part of the 372nd Infantry Regiment were on Maui for training between July 1943 and January 1946 (U.S. Army Museum, Fort De Russy 2002: untitled handwritten list of Army units on Maui during World War II, personnel movement log for the U.S. Army 391st Regiment). Navy fliers and air personnel were stationed at Puunene Air Station. The U.S. Marine Corp's 4th Division set up their base of operations at Camp Maui, near Ha`ikū. The Army set up a hospital and cemetery in the town of Makawao (Allen 1945:199).

Connections with the current project parcels remain unclear. The Navy personnel mentioned above were located far from both parcels. Little is known about the activities of the Army groups who built the hospital and cemetery at Makawao, or about the locations used by the Army for training. Only the 4th Marine Division, or the Fighting 4th as they call themselves, based at Camp Maui, are known to have trained near the current project sites. For that reason, the focus of this section will be on their activities.

The Fighting 4th made a big impression on the people of Maui and specifically on people in the Makawao and Ha`ikū communities, which are not far from the current project areas. The various divisions of the U.S. Marine Corps keep up Internet sites filled with information on the history of their respective divisions. The 4th Marines are no exception, and the site "fightingfourth.com", which they maintain, has a description of their time on Maui. The information contained herein is taken largely from that source.

The 4th Marine Division saw combat in Kwajalein, the Marianas, and on Iwo Jima, and they made Maui their home away from home (U.S. Army Museum, Fort De Russy 2002: undated army bulletin regarding the U.S. Marine Corps 4th Division; U.S. 4th Marine Division 2002 [<http:fightingfourth.com]). Camp Maui was located on the slopes of Haleakalā. The elevation was 1500 feet, and the weather on the side of the mountain was rainy and often unpleasant. The 4th Marines built their barracks, mess halls, and baseball diamonds there. USOs were established in Wailuku, Makawao Town, Ha`ikū, and Kahului, and the people of Maui opened their doors to the Marines. An example of the *aloha* shown the Marines by Maui's people is evident in the excerpt quoted on the next page, which suggests that the famous saying "Maui no ka oi!" be altered to read "Maui Marines no ka oi" (http:fightingfourth.com/Maui.htm).

Maui's primary role during World War II, and particularly during the last two years, was in the training of the men who would fight the battles of the Pacific. The terrain and beaches of Maui were a tough proving ground for military personnel, the Fighting 4th included. According to 4th Division personnel, there were 47 training areas on Maui, most of them belonging to the Army (http://fightingfourth.com/Maui.htm). Amphibious maneuver areas, obstacle courses, and demolitions and rifle ranges were located around the island. `Ōpana Point served as the Division's 100-target rifle range, and another area near `Ōpana Point (exact location not described) was used to train motor transports to move troops and supplies under either nighttime or daytime combat conditions. There was also a bazooka area "in a gulch opening into the sea" about 5 miles east of Camp Maui. Finally, approximately 10 miles of coastline east of Camp Maui was covered with combat firing ranges, which were used for the maneuvering and firing of tanks and halftracks (http://fightingfourth.com/Maui.htm). Archival records indicate that the U.S. Navy Department acquired 1002 acres in Halehaku, Maui, and it seems likely that this parcel was used as a training area, as there is no record of a permanent base in the area (Commissioner of Public Lands 1944).

The 4th Marines lived and trained on Maui for just four months before joining the 2nd Marine Division and the 27th Infantry Division (U.S. Army) for the assault on Saipan. Saipan was secured after 25 days of combat, and the 4th Division went immediately to land on Tinian. Tinian fell in just nine days. After the fall of Tinian, the 4th Division returned to Maui and received its first Presidential Unit Commendation. In February, 1945, the 4th left Maui again and were part of the large-scale seizure of the island of Iwo Jima,

which has long been credited as one of the worst battles of the war (U.S. Army Museum, Fort De Russy 2002: undated army bulletin regarding the U.S. Marine Corps 4th Division). The Marines returned to Maui once more, and received another Presidential Unit Commendation and a hero's welcome from their Maui family:

> ALOHA
>
> Hi, you Marines! Welcome home! It's no "snow job" when we tell you that the servicemen and women and the civilians of Maui are throwing this big shindig for you because we think you're just about the greatest guys that ever landed on this Island. When the news came over the radio that the Marines had hit Iwo Jima, everybody asked the same question, "Are the Maui Marines there?" Then we heard the news flash that you and a lot of other Marines were in there pitching. After that, nothing else that happened seemed to matter very much. We don't need to tell you that everyone from Hana to Lahaina is mighty proud of you. And when we read that you had named that first street "Maui Boulevard", we were practically bursting at the seams.
>
> So welcome to Maui--the old friends and the new! Welcome to Iao Valley and Haleakala---to the rainbows and the rain (that everlasting rain at Camp Maui)--the steaks and the banana splits--the pineapples and the poi--the carnation leis and the steel guitars. But, most important of all, welcome back to all the folks on Maui who think it might be a pretty good idea to add a new word to the famous slogan, MAUI NO KA OI and let the world know it is now, MAUI MARINES NO KA OI! [http://fightingfourth.com/Maui.htm]

Following their return from Iwo Jima, and until the end of the war, the men of the 4th Division continued building up Camp Maui until they considered Maui the "next best thing to home" (http://fightingfourth.com/Maui.htm). The 4th left Maui shortly after Japan surrendered in August, 1945, and were decommissioned at Camp Pendleton in California in November of that year. Ha`ikū residents and members of the 4th Division worked together to create a memorial park at the site of Camp Maui. It is dedicated to the men of the Fighting 4th who were killed in action in the Marianas and on Iwo Jima.

ARCHAEOLOGICAL SITES DOCUMENTED PREVIOUSLY

Although relatively few archaeological studies have been completed in northern portions of the current Makawao District, a number of sites have been documented in the portion formerly called Hāmākualoa. The earliest information presented here concerning Hāmākualoa's *heiau* (Hawaiian temple) sites was provided by Walker (1931); Walker's information is also summarized by Sterling (1997). Updated information regarding the condition of some *heiau* sites, and also concerning sites discovered more recently throughout Hāmākualoa, comes primarily from four reports: Dunn et al. (1995), Dunn and Spear (1996), Eblé et al. (1997), and Sinoto and Pantaleo (1992).

Table 2 here is an attempt to bring together, for the first time, all the available site information for Hāmākualoa District. Site organization in the table is geographical: the first sites listed are located at the east end of Hāmākualoa, at or near the boundary with (former) Ko`olau District; the last entries are located in the west, near the boundary with Hāmākuapoko. Each entry includes the approximate location of that site in relation to a constant reference point within the current project area: the cliff at Ōpana Point. All site entries for Ōpana and Halehaku, the two *ahupua`a* where the current parcels are located, are printed in bold font.

Table 2

Previously Documented Archaeological Sites in Hāmākualoa District,

Organized from East to West (Sites in `Ōpana and Halehaku *Ahupua`a* in Bold Font)

Site Name	Walker's Site No.; State Site No.*	Site/Feature Type(s)	*Ahupua`a*; Other Locational Information	Inland/Coastal; Location; Distance from Cliff at `Ōpana Point	Condition and Notes	Source(s) in Chronological Order
Nakeiki`ikalalo-makaīwa at Makaīwa	Walker 81; 50-50-06-81	*Heiau*	Prob.+ West Maka`iwa	Prob. coastal; ~11 km E	Destroyed by 1931	Walker 1931:151; Sterling 1998:101
Kalaeohia at Papaeaiki	Walker 80; 50-50-06-80	*Heiau*	Prob. Pāpa`a`ea or Pāpa`a`ea Nui	Prob. coastal; ~10 km E	Destroyed by 1931	Walker 1931:151; Sterling 1998:101
Halekanaloa at Papaea	Walker 79; 50-50-06-79	*Heiau*	Prob. Pāpa`a`ea or Pāpa`a`ea Nui	Prob. coastal; ~10 km E	Destroyed by 1931	Walker 1931:151; Sterling 1998:101
Pohakuokane?	Walker 78; 50-50-06-78	*Heiau*; walled; walls to 20 m (66 ft) long; 1.5 m high	Prob. Pāpa`a`ea	Inland; on ridge E of Kailua Gulch; ~9.8 km E	Intact in 1971	Walker 1931:166; Sterling 1998:107
Kauhihale	Walker 77; 50-50-06-77	*Heiau*	Pu`uomaile (or Pu`uomālie?; Pukui et al. 1986:204)	Inland, on *mauka* side of road; ~9.7-10 km E	Fair in 1971	Walker 1931:165; Sterling 1998:106
Halepa`ahau at Hanawana	Walker 76; 50-50-06-76	*Heiau*	Hanawana	Prob. coastal; ~9 km E	Destroyed by 1931	Walker 1931:165; Sterling 1998:106
Honomau`uloa at Hanawana	Walker 75; 50-50-06-75	*Heiau*	Hanawana	Prob. coastal; ~9 km E	Destroyed by 1931	Walker 1931:165; Sterling 1998:106

(Table 2 continued)

Site Name	Walker's Site No.; State Site No.	Site/Feature Type(s)	*Ahupua`a*; Other Locational Information	Inland/Coastal;Location; Distance from Cliff at `Ōpana Point	Condition and Notes	Source(s) in Chronological Order
Pohakuokaia	Walker 74; 50-50-06-74	*Heiau*; small, walled; jogging walls up to 18.3 m (60 ft) long	Hoalua (not near Kailua Gulch, as Sterling indicates)	Near-coastal; on bluff at Hoalua; ~8.9-9 km E	Present in 1971	Walker 1931:164; Sterling 1998:106
Kupaika`a	Walker 73; 50-50-06-73	*Heiau*; at least 28.7 by 14.6 m (94 by 48 ft); 6.1 m (20 ft) high	Hanehoi	Inland; on hillside; ~8.5 km E	Partially destroyed in ditch flood by 1931	Walker 1931:163; Sterling 1998:105-106
Pu`uokalepa	Walker 72; 50-50-06-72	*Heiau*	Prob. Puolua	Inland; on knoll by gulch; ~7.5-7.6 km E	Largely destroyed by 1931	Walker 1931:162; Sterling 1998:105
Oanapele	Walker 71; 50-50-06-71	*Heiau*; 30.5 by 18.3 m (100 by 60 ft); 3 m (10 ft) high	Prob. Waipi`o	Near-coastal; at "Puuoneone;" ?6-7 km E	Destroyed ca. 1931	Walker 1931:161; Sterling 1998:105
Mokupapa`akua	Walker 70; 50-50-06-70	*Heiau*	Waipi`o or Mokupapa	Near-coastal; Mokupapa Gulch; ~6.4 km E	Destroyed by 1931	Walker 1931:160; Sterling 1998:105
Pu`uokaupu	Walker 69; 50-50-06-69	*Heiau*	Honokalā	Inland; ~6 km E	Destroyed by 1931	Walker 1931:159; Sterling 1998:105
Po`oho`olewa	Walker 68; 50-50-06-68	*Heiau* - walled; enclosures; 91.4 m (300 ft) N-S, 39.6 m (130 ft) E-W	Prob. Ho`olawa	Near-coastal, on bluff ("Apiapi") near Honopou Gulch; ?½ mile inland; ~5 km E	Partially destroyed before inventoried by State (ca. 1973)	Walker 1931:158; Eblé et al. 1997:20; Sterling 1998:105
Honopou Burial State Reserve	50-50-06-1223	Burial platform, three levels	Prob. Ho`olawa	0.5 km inland from Ho`olawa Bay; ~4.7 km SE	Inventoried by State, 1970s	Dunn and Spear 1996:6; Eblé et al. 1997:20
Kīpapa of Kihapi`ilani	--	Rock-paved trail segment, part of road built by Kihapi`ilani (Maui ruler)	East of Halehaku	Near-coastal; unknown distance E	?	Reported by missionaries, 1828; Sterling 1998:104

(Table 2, continued)

Site Name	Walker's Site No.; State Site No.	Site/Feature Type(s)	*Ahupua`a*; Other Locational Information	Inland/Coastal;Location; Distance from Cliff at `Ōpana Point	Condition and Notes	Source(s) in Chronological Order
Ka`apahu at Kakipi	**Walker 65; 50-50-06-65**	***Heiau***	**Gulch between Keali`i Nui and Halehaku**	**?; ~3 km E**	**Destroyed by 1931**	**Walker 1931:151; Sterling 1998:101**
Unknown	**Walker 66; 50-50-06-66**	***Heiau* - terraced; N side 39 m long, E side 36.6 m, S side 35 m; 1.2 m high**	**Halehaku or Keali`i Nui; on bluff above Halehaku (Pīlale) Bay**	**Coastal; ?~3 km E**	**Partially destroyed before inventoried by State (ca. 1973)**	**Walker 1931:156; Eblé et al. 1997:20; Sterling 1998:103**
Pi`ilani	**Walker 67; 50-50-06-67**	***Heiau* - terraced, possible platform; 45.7 m along shore, 18.3 m deep**	**Halehaku or Keali`i Nui; on shore, Halehaku Bay**	**Coastal; ~3 km E**	**Intact when inventoried by State (ca. 1973)**	**Walker 1931:157; Eblé et al. 1997:50; Sterling 1998:103**
--	50-50-06-2798	Retaining wall, rock scatter on 30% slope	Keali`i Nui or Keali`i Iki	Inland; in Keali`i Stream gulch; 2.4 km SE	Deteriorated by 1992	Sinoto and Pantaleo 1992:7; Dunn and Spear 1996:7; Eblé et al. 1997:20-21
--	50-50-06-2799	Post-C+ road 3-4 m wide, with dry masonry retaining walls	Peahi	Inland; in Uaoa Gulch; ~2 km SE	Partially deteriorated by 1992	Sinoto and Pantaleo 1992:10; Dunn and Spear 1996:7; Eblé et al. 1997:20-21
Pu`uokaniau at Peahi	Walker 63; 50-50-06-63	*Heiau*	Peahi	Prob. inland; unknown distance S	Destroyed by 1931	Walker 1931:151; Dunn and Spear 1996:7; Eblé et al. 1997:20-21
Mokahio	Walker 64; 50-50-06-64	*Heiau* - multiple terraces; to 39.6 m (130 ft) wide; 26 m (85 ft) front to back	Peahi	0.4 km (¼ mile) inland; on knoll in gulch; ?~1 km S	Destroyed before State inventory (ca. 1973)	Walker 1931:155; Sterling 1998:102; Eblé et al. 1997:20

(Table 2, continued)

Site Name	Walker's Site No.; State Site No.	Site/Feature Type(s)	*Ahupua`a*; Other Locational Information	Inland/Coastal;Location; Distance from Cliff at `Ōpana Point	Condition and Notes	Source(s) in Chronological Order
--	50-50-06-4085	10 agricultural features, 1 petroglyph	Hea`aula	Inland; E side of Manawai Gulch; 1.3 km SE	Present, 1997; not located in 2001, believed destroyed	Dunn et al. 1995:9-17; Eblé et al. 1997:28; Haun and Henry 2001:1
--	50-50-06-4089	Rock concentration; clearing feature	Hea`aula	Near-coastal; 1 km SE	Present, 1995	Dunn et al. 1995:21-23
--	50-50-06-4090	2 rock alignments, 696 artifacts; house site/lithic workshop	Hea`aula	Near-coastal; 0.9-1 km SE	Damaged by machinery before 1995	Dunn et al. 1995:23-32
--	50-50-06-4087	Rock pavings, wall; habitation site	Hea`aula	Inland; E side of Manawai Gulch; 0.9 km SE	Present, 1995	Dunn et al. 1995:18-21
--	50-50-06-4093	Post-C road, cut and fill, with rock berm	Hea`aula	Near-coastal; E side of short gulch; 0.9 km SE	Present, 1995	Dunn et al. 1995:34-37
--	50-50-06-4088	Red ocher quarry	Hea`aula	Near-coastal, between gulches; 0.8 km SE	Present, 1995	Dunn et al. 1995:21
--	50-50-06-4091	Rock mound; agricultural	Hea`aula	Inland; E side of Manawai Gulch; 1.2 km S	Present, 1995	Dunn et al. 1995:33
Pahoa at Ōpana	**Walker 62; 50-50-06-62**	***Heiau* - platform**	**`Ōpana**	**Coastal; at `Ōpana Pt.**	**Destroyed by 1973**	**Walker 1931:151; Eblé et al. 1997:20; Sterling 1998:101**
--	**50-50-06-5108; Eblé et al's Find Spot 1**	**Basalt flakes, shell midden**	**`Ōpana**	**Coastal, at `Ōpana Pt.**	**Present, 2001**	**Eblé et al. 1997:74, 104; Haun and Henry 2001:6-8**

(Table 2, continued)

Site Name	Walker's Site No.; State Site No.	Site/Feature Type(s)	*Ahupua`a*; Other Locational Information	Inland/Coastal;Location; Distance from Cliff at `Ōpana Point	Condition and Notes	Source(s) in Chronological Order
Spreckels Ditch	50-50-06-4086	Metal flume (post-C sugar irrigation ditch)	Crosses `Ōpana, Hea`aula, Ulumalu, etc.)	Inland; segment E of Manawai Gulch; 1.5 km S	Preservation recommended in 2001	Dunn et al. 1995:18; Eblé et al. 1997:28; Haun and Henry 2001:3, 4
--	50-50-06-4182	Red ocher (?hematite) quarry	`Ōpana	Inland; w side of Manawai Gulch; 1.7 km S	Present, 1996	Dunn and Spear 1996:12-15
--	50-50-06-4094	Poss.+ ditch excavation; many basalt flakes	`Ōpana/ Hea`aula	Inland, in Manawai Gulch; 1.8 km S	Present, 1996	Dunn et al. 1995:34, 37-38 ; Dunn and Spear 1996:10-12
--	50-50-06-4095	Post-C road sections, prob. assoc.+ with Haiku Pineapple Cannery	`Ōpana and Hea`aula	Inland; both sides of Manawai Gulch; 5 segments, to 1.8 km S	Eroded; present, 1996	Dunn et al. 1995:38-39; Dunn and Spear 1996:12
Ha`ikū Ditch	50-50-06-4092	Post-C (sugar) irrigation ditch	`Ōpana in part	Inland; portion at Manawai Gulch, 1.8 km S	Preservation recommended in 2001	Dunn et al. 1995:33; Eblé et al. 1997:28, 32; Haun and Henry 2001:3, 4
Kapuai o Menehune at Kuloli, Ulumalu	Walker 61; 50-50-06-61	*Heiau*	`Ōpana	Inland; on Kūloli Hill; 3.3 km S	Destroyed by 1931	Walker 1931:151; Sterling 1998:101
--	50-50-06-4434	Prob. post-C rock retaining wall on slope	`Ōpana	Inland; "`Ōpana" Gulch; 0.4 km SW	Present, 1997; not located in 2001, believed destroyed	Eblé et al. 1997:68, 96, Fig. 19; Haun and Henry 2001:1
--	50-50-06-5168 (formerly 4435)	Prob. post-C rock retaining wall	`Ōpana	Inland; W side of "`Ōpana" Gulch; 0.6 km SW	Present, 1997; not located in 2001, believed destroyed	Eblé et al. 1997:68, 74, 96, Fig. 20; Haun and Henry 2001:1

(Table 2, continued)

Site Name	Walker's Site No.; State Site No.	Site/Feature Type(s)	*Ahupua`a*; Other Locational Information	Inland/Coastal;Location; Distance from Cliff at `Ōpana Point	Condition and Notes	Source(s) in Chronological Order
--	**50-50-06-4432**	**23 bait cups and grinding surfaces, on 3 or more boulders**	**Between `Ōpana and Ulumalu; ; formerly poss. Ka`alaea (Sterling 1998)**	**Coastal; in Holumalu Gulch; 1.1 km SW**	**Preservation recommended in 2001**	**Eblé et al. 1997:67-72; Sterling 1998:100; Haun and Henry 2001:3-4**
--	**50-50-06-4431**	**1 prob. *`auwai*, 4 pondfield terraces**	**`Ōpana/ Ulumalu; poss. Ka`alaea (Sterling 1998)**	**Inland; Holumalu Gulch; 1.2 km SW**	**Preservation recommended in 2001**	**Eblé et al. 1997:67, 96-98; Sterling 1998:100; Haun and Henry 2001:3-6**
--	**50-50-06-4433**	**Post-C test tunnel for irrigation system**	**Between `Ōpana and Ulumalu; poss. Ka`alaea**	**Inland; head of Holumalu Gulch; 1.8 km SW**	**Present, 2001**	**Eblé et al. 1997:68, 72, 114; Sterling 1998:100; Haun and Henry 2001:3, 4**
--	50-50-06-4430	Prob. post-C road, rock facings	Ulumalu	Inland; descends into Manawai`iao Gulch; 1.4 km SW	Present, 2001	Eblé et al. 1997:63, 66, 114; Haun and Henry 2001:3, 4
--	50-50-06-4429	Post-C excavation -- prob. charcoal kiln	Ulumalu	Inland; 150 m N of Spreckels Ditch; 1.8 m SW	Preservation recommended in 2001	Eblé et al. 1997:63, 91, Fig. 27; Haun and Henry 2001:3, 4
--	50-50-06-4427	6 features: pondfield terrace, mound, platform, retaining wall; 2 post-C charcoal kilns	Ulumalu	Inland; beside (S of) Spreckels Ditch; 1.9 km SW	Preservation recommended, 2001	Eblé et al. 1997:59-63, 91, 93-94, 113-114
--	50-50-06-4428	Post-C tunnel	Ulumalu	Inland; 1.9 km SW	Present, 2001	Eblé et al. 1997:63, 114; Haun and Henry 2001:3, 4

(Table 2, continued)

Site Name	Walker's Site No.; State Site No.	Site/Feature Type(s)	*Ahupua`a*; Other Locational Information	Inland/Coastal;Location; Distance from Cliff at `Ōpana Point	Condition and Notes	Source(s) in Chronological Order
--	50-50-06-4426	Rock mound, terrace (prob. agric.+); overhang lacking cultural evidence	Ulumalu	Inland; on W bank, Manawai`iao Stream; 2 km SW	Preservation recommended, 2001	Eblé et al. 1997:55, 58-60, 88, 91, 113-114; Haun and Henry 2001:3, 6
--	50-50-06-4425	4 prob. agric. features: terraces, rock alignment, modified outcrop	Ulumalu	Inland; in Manawai`iao Gulch; 2.1 km SW	Preservation recommended, 2001	Eblé et al. 1997:55-57, 88, 113-114; Haun and Henry 2001:3, 4
--	50-50-06-4424	17 prob. agric. features: rock-faced terraces, mounds, alignments	Ulumalu	Inland; E bank, Manawai`iao Stream; 2.2 km SW	Preservation recommended, 2001	Eblé et al. 1997:49-55, 85-88, 113-114; Haun and Henry 2001:3 ,6
--	50-50-06-4423	21 prob. agric. features: rock-faced terraces, walls, alignment; mounds (1 post-C, with concrete)	Ulumalu	Inland; S bank, Manawai`iao Stream; 2.1 km SW	Preservation recommended, 2001	Eblé et al. 1997:40-49, 82, 84-85, 113-114; Haun and Henry 2001:3, 6
--	50-50-06-4421	Rock alignment, terrace (prob. agric.) with retaining wall	Ulumalu	Inland; 43 m N of Ha`ikū Ditch, in Manawai`iao Gulch; 2.3 km SW	Preservation recommended, 2001	Eblé et al. 1997:32, Fig. 9, 82, 113-114; Haun and Henry 2001:3-4, 6
--	50-50-06-4422	6 rock features (prob. agric.); 2 post-C cisterns,	Ulumalu	Inland; in Manawai`iao Gulch; 2.3 km SW	Preservation recommended, 2001	Eblé et al. 1997:37-40, 113-114; Haun and Henry 2001:3, 4, 6
Kaupakulua Agricultural Complex	50-50-06-1221	Pondfield terraces, other agricultural features	East Kaupakulua	0.8-1.6 km (½-1 mile) inland; East Kaupakulua Gulch; ~2.5-2.7 km SW	Inventoried by State, 1970s	Dunn and Spear 1996:6; Eblé et al. 1997:20

(Table 2, concluded)

Site Name	Walker's Site No.; State Site No.	Site/Feature Type(s)	*Ahupua`a*; Other Locational Information	Inland/Coastal;Location; Distance from Cliff at `Ōpana Point	Condition and Notes	Source(s) in Chronological Order
--	50-50-06-4079	L-shaped rock alignment, rock pavement, *`auwai*	Kuiaha	Prob. inland; ~3-4 km SW	Present in 1984	Dunn and Spear 1996:7
Pakialele	Walker 59; 50-50-06-59	*Heiau* - platform, reportedly 7.6 m (25 ft) square, 1.2 m (4 ft) high	Field near Pa`uwela	Inland; ~4 km SW	Destroyed by 1931	Walker 1931:153; Sterling 1998:102
Heiau at Waikikena	Walker 60; 50-50-06-60	*Heiau* - reportedly three-terraced, walled platform	Pa`uwela or Kui`aha	Unknown location ("Hanapopolo"); ?3-5 km SW	Destroyed by 1931	Walker 1931:154; Sterling 1998:102

*In the Hawaii State numbering system, the first 50 = Hawai`i, the second 50 = Maui, 06 += Haiku topographic quadrangle, and the final digits = the unique site number. The prefix "50-50-06-" is omitted in the text, but is included in this table for reference.

+Agric. = agricultural; assoc. = associated; poss. = possibly; post-C = post-Contact (post-A.D. 1778); prob. = probably.
Directions abbreviated E, S, W, N.

Note: One additional site, Site 50-50-06-2928, which is not described in the available literature, is plotted on a small-scale aerial photograph at the State Historic Preservation Division website (<http://mano.icsd.hawaii.gov/~ckomoek/maui/mauihei.htm>). It appears located in East Kaupakulua Gulch and may be less than 3 km SW of `Ōpana Point.

Of the 57 archaeological sites listed in Table 2, 46 are (either wholly or in part) traditional Hawaiian sites that may predate European contact in A.D. 1778. The remaining 11 sites, and certain features at the traditional sites, are interpreted by the researchers as postdating Contact.

Twenty-three (50 percent) of the 46 documented traditional Hawaiian sites are described as *heiau*, either walled, terraced, or of platform type, or with both freestanding walls and terraces or platforms. The other 23 traditional sites include a three-tiered burial platform (Site [50-50-06-]1223; the prefix "50-50-06-" is omitted in site references throughout the text); four house sites or work areas, including a house site with a lithic workshop (Site 4090) that produced nearly 700 artifacts, and other sites (Site 4087, 5108, 4094) that represent either habitation (probably temporary) or workshops; 11 pondfield and dryland agricultural sets, including a set of 10 pondfield terraces (Site 4085) associated with a petroglyph, two sites (Sites 4079, 4431) with probable *`auwai* (traditional irrigation ditch) segments, and eight others (Sites 1221, 4421-4427) with either pondfield or dryland agricultural features or both; a site (Site 4432) with three boulders and at least 23 bait cups and grinding surfaces; two "red ocher" (either laterite or hematite) quarries (Sites 4088, 4182); a rock-paved road segment (no site number); and rock features such as retaining walls (Site 2798) and rock mounds and concentrations that are probably agricultural (Sites 4089, 4091).

The 11 entirely post-Contact sites include commercial agriculture-related features -- irrigation ditches (Sites 4086, 4092), tunnels (Site 4428, 4433), and roads (Sites 2799, 4093, 4095, 4430) -- and other smaller-scale features probably used by families -- a charcoal kiln (Site 4429), and rock retaining walls (Sites 4434, 5168). Six additional post-Contact features were found at four of the 46 traditional sites, suggesting either site use that had continued from the pre-Contact period or resumed site use; these include a possible irrigation ditch excavation at Site 4094, two charcoal kilns at Site 4427, a rock mound containing concrete fragments at Site 4423, and two cisterns at Site 4422.

As suggested by Eblé et al. (1997:112-118), the presence of post-Contact rock retaining walls and other features in gullies suggests that small-scale, probably family-based, subsistence agriculture continued in gullies throughout the area as the plateaus were increasingly dominated by estate pineapple production. The gully agriculturalists may have been farmers who also worked on the commercial estates.

Figure 6 locates on a topographic map (U.S. Geological Survey 1983) all sites and former site locations listed in Table 2 that are both: 1) plotted relatively securely in the available literature; and 2) located within 3.5 km of the cliffline at `Ōpana Point. Most *heiau* described by Walker are not located securely; some, including Sites 0061 and 0065 in the figure, have been destroyed. Two *heiau* sites (Sites 0064, 0066) could not be plotted.

Thirteen sites include features either in `Ōpana *ahupua`a* or in the gulches between it and two adjacent *ahupua`a*, Hea`aula in the east and Ulumalu in the west. Although no sites have been reported for Halehaku *ahupua`a*, one *heiau* (Site 0067) is located between Halehaku and Keali`i Nui, on the shore of Halehaku (Pīlale) Bay, and two other *heiau* (Sites 0065, 0066) were formerly located between these *ahupua`a* -- one overlooking the bay and the other in the gully. Traces of Site 0066, overlooking the bay, may remain. The mapped site locations are based on information provided by the sources cited in Table 2, and on the Hawaii State Historic Preservation Division's Geographical Information Systems (GIS) site maps available on the Internet (<http://mano.icsd.hawaii.gov/~ckomoek/maui/mauihei.htm>).

SITES IN AND ADJACENT TO `ŌPANA *AHUPUA`A*

Of the 13 sites in or next to `Ōpana *ahupua`a*, two are *heiau* that were destroyed before they were documented in the late 1920s, and a third is a lithic scatter that may possibly have been associated with one of these *heiau.* Pahoa Heiau (Site 0062), above the coastal cliff at `Ōpana Point (see Figure 6), had reportedly been destroyed by pineapple cultivation. Only a small platform remnant was present when the site was first visited (Walker 1931:51; Sterling 1998:101). Although no structural remains were found

when the area around Pahoa Heiau was resurveyed and tested in 1997, Eblé et al. (1997:96, 99-104, 114) found an artifact scatter (Find Spot 1) eroding out of the cliff face. Find Spot 1 was designated Site 5108 by Haun and Henry (2001), who revisited Eblé et al's sites to update site condition information and reassess interpretations. At Site 5108, Eblé et al. (1997:74, 106) recovered non-diagnostic marine shell fragments, 10 basalt flakes, a core, a piece of basalt debitage, and three manuports (waterworn basalt cobbles). Haun and Henry (2001:6) report additional basalt flakes and waterworns, a waterworn coral fragment, and a *Conus* shell fragment, all eroding down the cliff from a single cultural layer 20-40 cm below the surface (cmbs).

The second *heiau* in `Ōpana *ahupua`a*, Site 0061, located more than 3 km inland, on Kūloli Hill, had been completely destroyed before Walker's visit. The location shown in Figure 6 is approximate.

The 10 additional sites in or adjacent to `Ōpana *ahupua`a* include four traditional sites mentioned earlier: Site 4094 Feature 2 and Site 4182, a flake scatter and an ocher quarry, in Manawai Gulch; and Sites 4431 and 4432, the grinding stone site and a pondfield set with an *`auwai*, in Holomalu Gulch. Six post-Contact sites include portions of Sites 4086 and 4092, both irrigation ditches; Site 4095, road segments; Sites 4434 and 5168, retaining walls; and Site 4433, a tunnel. Most of these are associated with commercial cultivation. The retaining walls, which may have been associated with subsistence cultivation, are located in the small gulch Eblé et al. (1997) call `Ōpana Gulch.

DOCUMENTED SITES ADJACENT TO HALEHAKU *AHUPUA`A*

As indicated, no archaeological sites have been documented within Halehaku. The reason is probably one of preservation: the area has been used extensively as ranch land; prior to ranching, it may possibly have been used for pineapple cultivation.

Three sites have been documented between Halehaku and Keali`i Nui, the next *ahupua`a* east. All are *heiau*, and all were recorded by Walker (1931). Two (Sites 0066, 0067), beside Halehaku (Pīlale) Bay, are intact or partially destroyed. The third, Site 0065, at an unknown location in the gully between Halehaku and Keali`i Nui *ahupua`a*, was destroyed before Walker (1931) visited the area.

SITES IN *AHUPUA`A* BETWEEN `OPANA AND HALEHAKU

Three sites, all in inland locations, have been described for Peahi *ahupua`a*, immediately west of Halehaku and east of inland portions of `Ōpana *ahupua`a*. These include two *heiau*, Sites 0063 (location unknown) and 0064 (on "a small knoll in a gulch a quarter of a mile from the sea" [Walker 1931:155]), and a post-Contact road, Site 2799, in Uaoa Gulch (Dunn and Spear 1996; Eblé et al. 1997; Sinoto and Pantaleo 1992; Walker 1931).

Eleven sites (Sites 4085 to 4095) are described for Hea`aula *ahupua`a*, immediately east of `Ōpana Point, by Dunn et al. (1995, citing the *ahupua`a* as Kea`aula). Three post-Contact sites (Sites 4086, 4092, and 4095 -- ditches and roads) were described above for `Ōpana, which they also cross. The fourth site, Site 4094, is located on the east side of Manawai Gulch (near the boundary with `Ōpana); Feature 1 is an excavation probably associated with a ditch. The fifth site, Site 4093, in a short gulch near the coast, is a road that is also interpreted as post-Contact in origin.

The six remaining sites in Hea`aula, and Feature 2 at Site 4094, may predate Contact. The Site 4094 Feature 2 scatter, in Manawai Gulch, produced 120 basalt pieces (two hammerstones, one modified flake, and debitage) during excavation. Three additional sites occupy the east side of Manawai Gulch: as mentioned, Site 4085 is a pondfield terrace set with a petroglyph; Site 4087 is a house site with a paving; Site 4091 is probably a dryland agricultural mound. The final three sites occupy plateau areas near the coast: Site 4088 is an ocher quarry; Site 4089 is a clearing mound; and Site 4090 is a probable habitation site with lithic workshop. Excavations at Site 4090 (Dunn et al. 1995:23-32) yielded 696 basalt artifacts (nine tools including hammerstones, modified flakes, and an adz preform; and 687 pieces of debitage).

Two charcoal samples collected from cobble pavings in Layer I Level 3 (20-30 cmbs, in a cultural layer 40-46 cm thick), produced seventeenth- to mid-twentieth-century calibrated date ranges. The preferred ranges cited (Dunn et al. 1995:41) are late eighteenth- to mid-twentieth-century.

SETTLEMENT PATTERNS

The project area encompasses two broad environmental zones, coastal and inland, in terms of elevation and drainage patterns. Two different settlement patterns are expected, one for the `Ōpana Point area, and the other for the broad plateau areas of the former Makawao Gunnery Site.

Little is yet known archaeologically regarding pre-Contact habitation along the Hāmākualoa coastline, which is dominated by dangerous cliffs and battered by equally dangerous offshore waters. The numbers of coastal and near-coastal *heiau* listed in Table 2 suggest considerable ceremonial importance for coastal headlands and bays; whether this importance may have increased during the late eighteenth century period of warfare and conquest in this district is not known. As Eblé et al. (1997:23) suggest, the number of *heiau* may suggest a formerly dense population. Handy and Handy's (1972) suggestion that the area's many small *ahupua`a* suggest a formerly dense population was mentioned earlier.

The cliffs at `Ōpana Point would have made exploitation of marine resources difficult, although some gully mouths and bays allowed access not far away. Coastal sites might expected to include additional temporary habitation and tool production sites like Site 5108 at `Ōpana Point, which, although located near Site 0062 (Pahoa Heiau), may have been occupied centuries before that site was built. The fact that the upland plateaus extend all the way to the coastal bluff in many areas would have made extensive dryland (non-irrigated, rainfed) agricultural lands available; unfortunately, coastal areas are so modified that signs of dryland agriculture may be difficult to recognize. Permanent habitation sites and more extensive workshops probably occupied bayshores and any areas where relatively easy access to marine resources was possible.

Inland, the archaeological evidence is beginning to accumulate for former land uses. As Eblé et al. (1997) and others have suggested, use emphasized the gullies that segment the plateau lands throughout the area. Even seasonal streams provided water occasionally, as well as arable soils and rock for use as building material. Post-Contact house sites tend to occupy downstream locations; permanent house sites had probably occupied these wider valley areas earlier, as well. One change in the model for inland settlement patterns is suggested by very recent evidence, that collected by Eblé et al. (1997) and reinterpreted by Haun and Henry (2001): mounting evidence suggests more extensive wetland (pondfield) agricultural use of middle stream reaches before Contact than was previously thought to be the case. Other traditional agricultural uses of these gullies, including upper stream reaches, included dryland agriculture; use of overnight or seasonal shelters on gully slopes; quarrying of hematite and basalt; and probably workshops associated with the quarries.

The plateau lands would have held dryland fields and rock clearing features. After Contact, these lands were modified for the construction of ditches and roads, and then by ranching. Most structural evidence for earlier habitation and agricultural activities has probably been destroyed during development and ranching activities.

RESEARCH FOCUS

The following report section summarizes the tasks set out for survey and monitoring in the scope of work for the project (U.S. Army Engineer District, Honolulu, 2002). The monitoring focus is also discussed in the archaeological monitoring plan (Nees and Clark 2002).

INVENTORY SURVEY

The research focus for this project involved establishing whether any archaeological resources were present, and interpreting how they may have fit within the pre- and early post-Contact settlement network in East Maui. As stipulated in the scope of work, the archaeological inventory survey was conducted in compliance with National Historic Preservation Act Section 106, to ensure that any endangered and potentially significant cultural resources are not adversely affected by the planned engineering evaluation and cost analysis (EE/CA) for UXO removal.

The survey focused on areas where a former aerial target range had existed and where unexploded ordnance may be present at both `Ōpana Point and the gunnery site (see Figures 1, 2). These areas included cleared fields and other areas identified by Zapata Engineering as future testing sites ("grid" locations), and roads and other clearings that would provide access routes to the grids.

ARCHAEOLOGICAL MONITORING

The research focus for monitoring, like that for the inventory survey, was identification of any cultural resources, and their characterization within a framework of known East Maui sites and settlement patterns. Archaeological monitoring during EE/CA activities was required to provide the opportunity to inspect subsurface deposits possibly associated with cultural resources, and to mitigate any damage to potentially significant resources.

As summarized in the monitoring plan (Nees and Clark 2002), the cultural landscapes within the two parcels, and the types and locations of archaeological sites previously identified in the general area, suggested that subsurface deposits might exist in either parcel. The primary objectives of archaeological monitoring and sampling were: 1) to determine whether or not archaeological deposits are present within each sampling grid, and 2) to determine the nature and age of any archaeological deposits encountered. These objectives were accomplished through examination of each excavation unit following the removal of UXO.

FIELD METHODS

Field methods involved close coordination with the DEI and Zapata Engineering representatives at all times, to avoid injury or mishap. The survey methods used by the archaeological team (Allen, Moorman, Nees, and O'Hare) are summarized first below, followed by the methods used by Nees during monitoring.

ARCHAEOLOGICAL INVENTORY SURVEY

The archaeological survey achieved 100 percent coverage of the grids established by Zapata Engineering for future sampling, and the routes to be used for access to the grids, using a team of four archaeologists, who walked systematic transects spaced 5-10 m apart. Nine grids and a large area beyond the grids were surveyed at the former `Ōpana Point Bombing Range; 16 grids were surveyed within non-national forest lands at the former Makawao Gunnery Site (see Figures 1, 2).

Visibility was excellent within most sampling grids where the ground was under low grass; the surface in forested areas was generally clear of vegetation. The transect lines followed existing roads whenever possible, making visibility good there as well.

A UXO specialist provided by DEI accompanied the archaeologists during all survey work. Upon discovery of potentially hazardous ordnance, the specialist determined whether the item was hazardous. If so, the find was flagged for removal, and the area was avoided.

The methods to be used during the survey included flagging of all archaeological sites with brightly colored tape. Each site would be labeled with a temporary field number, the date, transect or grid

number, the initials of the surveyor, and the company name. Plan maps and representative cross-sections of sites would be prepared, using metric tape and pocket transit (with foresighting, backsighting, and slope calculation as needed). Each site was to be described systematically, using standard AMEC site forms; photographed with a digital camera; and plotted on the Haiku U.S. Geological Survey (1983) topographic quadrangle; and additionally located using a Trimble Global Positioning System (GPS) unit. GPS coordinates would be differentially corrected at the AMEC office.

ARCHAEOLOGICAL MONITORING

Archaeological monitoring was conducted at localities within the Phase II EE/CA UXO sampling grid on September 11 and October 1, 2002, during the latter portion of the EE/CA investigations. In accordance with Zapata Engineering's Health and Safety Plan, no monitoring was permitted during exploratory excavations, when only UXO personnel were allowed within 762 m (2,500 feet) of active excavation. Only after the grid was clear was an examination of the hole permitted.

Monitoring involved examination of all visible faces within the excavations after any UXO had been removed. The types of evidence sought included cultural soils and subsurface features, artifacts, midden, and charcoal.

RESULTS OF FIELDWORK

No archaeological sites or newly documented historical sites were found during survey or monitoring. The following subsections summarize the few isolated cultural finds that were recorded in the two project areas.

INVENTORY SURVEY

As noted above, no cultural sites were recorded in either parcel. Traditional Hawaiian cultural materials recorded at the former `Ōpana Point Bombing Range, all disturbed during earlier military or agricultural activities, include a few pieces of basalt that may have been flaked, rare marine shell fragments including a *Cypraea* (cowry) fragment that probably represents midden, and waterworn (rounded) pebbles and cobbles -- manuports, as no streams cross the plateau here. Many fragments of concrete with gravel inclusions may represent an old military facility; an iron I-beam and other metal fragments were also observed. These finds were located in roads and cleared areas or under low vegetation.

A few flakes and waterworns were noted near the reported former location of Pahoa Heiau (Site 0062), as were several scarred waterworn boulders that had been moved around by machinery in the general area where the former Pahoa Heiau had been located; these did not appear aligned or intentionally modified.

Eleven MK-23 4-pound practice bombs were found by the archaeological team (e.g., Figure 7) in clearings and under low vegetation in the eastern portion of the bombing range. The bombs found by the UXO and other team members during survey and earlier phases of the investigations total more than 80.

Occasional rounded boulders and cobbles were also recorded at the former Makawao Gunnery Site; these also appeared culturally deposited, as they were located on the plateau, well above existing streambeds. One isolated fragment of a dark green ("black") glass bottle that may have been manufactured in the nineteenth century was found on the plateau. One historical site, the New Hāmākua Ditch, and an associated road mark the south boundary of the gunnery site; a portion of the Lowrie Ditch crosses the north portion of the project area.

ARCHAEOLOGICAL MONITORING

No cultural resources predating World War II were recorded during examination of 25 excavated UXO sampling holes in four grids at the former `Ōpana Point Bombing Range, or that of 50 excavations in the

five grids sampled at the Makawao Gunnery Site. More than 70 additional MK-23 4-pound practice bombs, two 60-mm mortars, two 105-mm artillery rounds, and a 4.5 barrage rocket were recovered during this phase of the UXO cleanup project.

The excavated holes ranged in size from 0.20 m to 0.90 m in diameter and had a maximum depth of 150 cmbs. Two stratigraphic layers were observed in each of the project parcels; neither layer appeared cultural in either area. At `Ōpana Point, Layer I extended to 30 cmbs; the soil appears disturbed, probably by pineapple cultivation. Layer II extended to the excavation floor at 75 cmbs; it is a C-horizon soil that contains decomposing rock fragments. No subsurface traditional cultural deposits were observed.

In the Makawao Gunnery Site project area, Layer I is 35 cm deep on average. It contains recent trash (e.g., soda cans, plastic, glass) and shows the effects of disturbances during ranching activities. Layer II, which was excavated to 150 cmbs, is an intact C-horizon soil that produced no cultural material.

CONCLUSIONS AND RECOMMENDATIONS

No archaeological sites or subsurface cultural deposits were observed at either the `Ōpana Point Bombing Range or the Makawao Gunnery Site, probably because of extensive ground surface modifications over the last 50 years, during pineapple cultivation at `Ōpana and ranching at the gunnery site. Previously reported evidence, however, suggests that `Ōpana Point was once well-used. This evidence includes the former *heiau* and the lithic scatter at the point; house sites, agricultural sites, and work areas up to 1.5-2 km inland in both Manawai Gulch, east of `Ōpana Point, and Manawai`iao Gulch, to the west; and sites in Holumalu Gulch that include the complex of grinding facets and bait cups near the coast, and a pondfield site with *`auwai* at the head of the gulch, 1.5 km inland.

Even farther inland, *heiau* are known to have existed. It is likely that, if the large, deep gullies with flowing streams that border the Makawao Gunnery Site are surveyed at a future date, they will also be found to contain sites, which will probably include subsistence dryland agricultural sites and possibly pondfield terrace sets, as well as temporary habitation sites, quarries, and lithic workshops. Historical evidence, although it is scant for the project areas thus far, also suggests that additional signs of post-Contact use of the Makawao Gunnery Site area, associated with commercial pineapple cultivation or with irrigation for sugar cane cultivation, may continue to be found.

If ordnance cleanup should make it possible to survey the large gulches (where ordnance has undoubtedly accumulated) at some future time, survey is strongly recommended; the gulches are the most promising locations for traditional sites. On the tablelands, even in areas where the current ground surface has been modified, it is possible that truncated or even intact cultural deposits still exist subsurface, beneath the zone of surface disturbance.

Archaeological monitoring of any future ground-modifying activities, to be conducted by qualified archaeologists, is recommended in both project areas, to ensure that any undiscovered sites are documented, and that past land use in both coastal and inland portions of Hāmākualoa District will eventually be better understood.

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FIGURES

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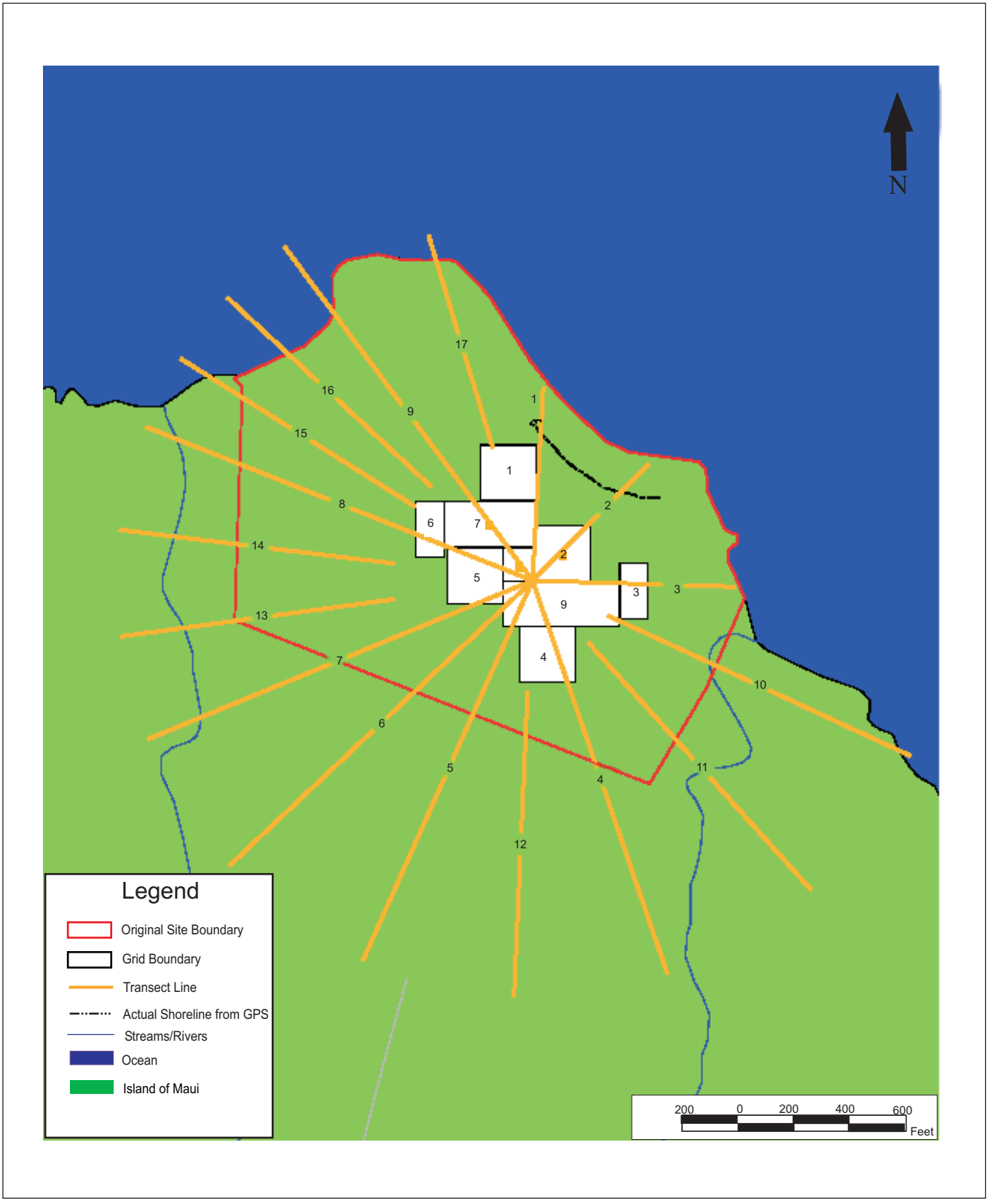

Figure 1. Former `Ōpana Point Bombing Range, Showing Grids for UXO Testing. Modified after map prepared by Zapata Engineering

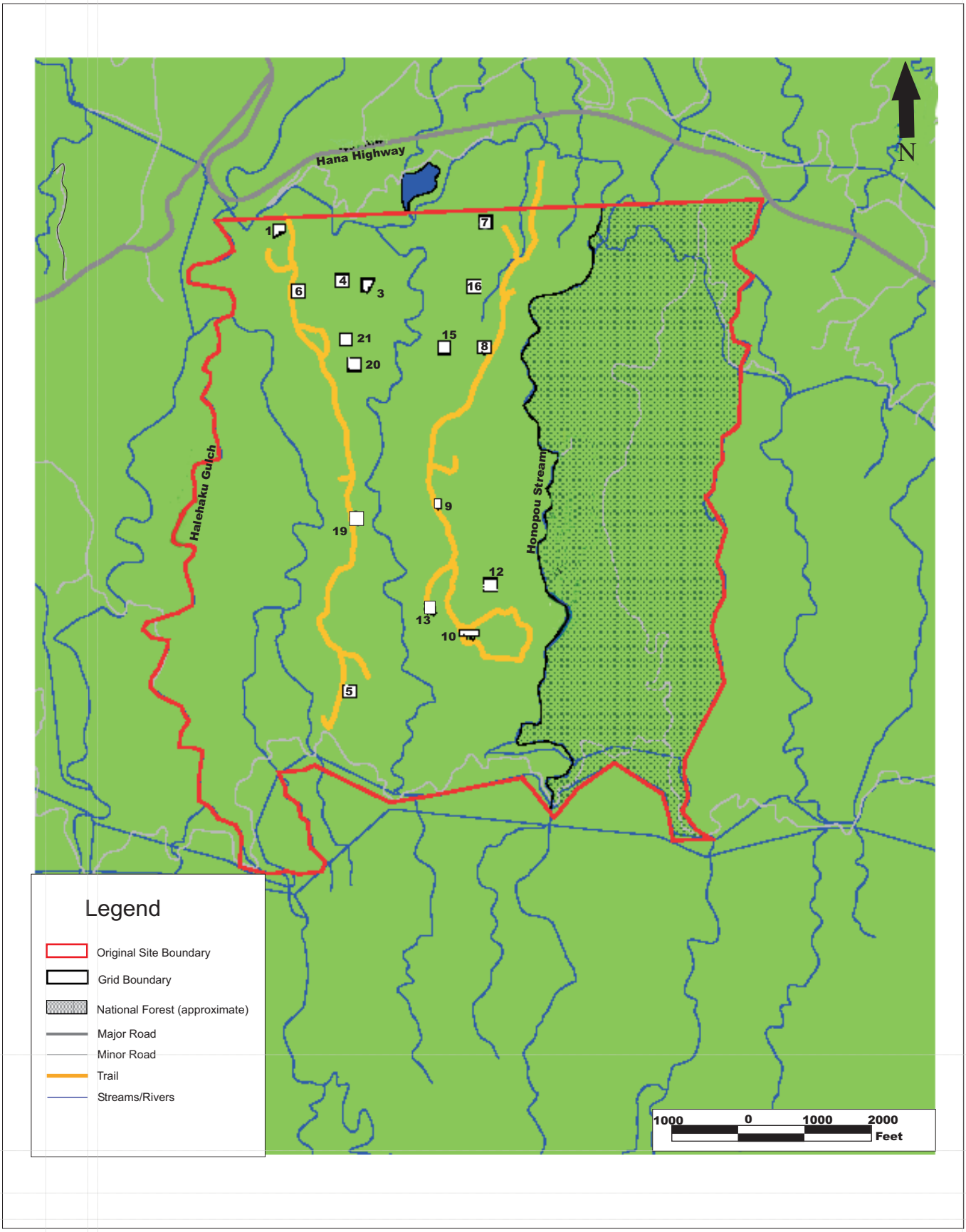

Figure 2. Map of Former Makawao Gunnery Site, Showing Grids for UXO Testing. Modified after map prepared by Zapata Engineering

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**Figure 3. Photograph,
Cliffline at `Ōpana Point.
View to Southwest**

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Figure 4. Photograph,
Pastureland and Forest Border, Makawao Gunnery Site.
View to Northeast

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Figure 5. Photograph,
Dense Ground Cover, Makawao Gunnery Site.
View to East

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Figure 7. Photograph, MK-23 4-Pound Practice Bomb at `Ōpana Point Bombing Range. (See arrow)